FORM PCT 1390 REV. 5/93 U.S. DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE

ATTORNEY'S DOCKET NO.
MARTIN, G. (PCT)

TRANSMITTAL LETTER TO THE UNITED STATES DESIGNATED/ELECTED OFFICE (DO/EO/US) CONCERNING A FILING UNDER 35 U.S.C. 371

U.S. APPLICATION NO (if known, see 37 CFR 1.5)
09/980343

INTERNATIONAL APPLICATION NO.	INTERNATIONAL FILING DATE	PRIORITY DATE CLAIMED
PCT/DE00/01808	31 MAY 2000	3 JUNE 1999

TITLE OF INVENTION
SURFACE ACOUSTIC WAVE FILTER

APPLICANT(S) FOR DO/EO/US
GÜNTER MARTIN

Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:

1. X This is a **FIRST** submission of items concerning a filing under 35 U.S.C. 371.
2. ___ This is a **SECOND** or **SUBSEQUENT** submission of items concerning a filing under 35 U.S.C. 371.
3. X This is an express request to begin national examination procedures (35 U.S.C. 371 (f)) at any time rather than delay examination until the expiration of the applicable time limit set in 35 U.S.C. 371(b) and PCT Articles 22 and 39(1).
4. X A proper Demand for International Preliminary Examination was made by the 19th month from the earliest claimed priority date.
5. X A copy of the International Application as filed (35 U.S.C. 371(c)(2)
   a. X is transmitted herewith (required only if not transmitted by the International Bureau)
   b. ___ has been transmitted by the International Bureau.
   c. ___ is not required, as the application was filed in the United States Receiving Office (RO/US).
6. X A translation of the International Application into English (35 U.S.C. 371(c)(2)).
7. ___ Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371(c)(3)).
   a. ___ are transmitted herewith (required only if not transmitted by the International Bureau).
   b. ___ have been transmitted by the International Bureau.
   c. ___ have not been made; however, the time limit for making such amendments has **NOT** expired.
   d. ___ have not been made and will not be made.
8. ___ A translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)).
9. X An oath or declaration of the inventor(s) (35 U.S.C. 371(c)(4)).
10. ___ A translation of the annexes to the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371(c)(5)).

Items 11. to 16. below concern other document(s) or information included:

11. X An Information Disclosure Statement under 37 CFR 1.97 and 1.98.
12. X An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.
13. X A **FIRST** preliminary amendment.
    ___ A **SECOND** or **SUBSEQUENT** preliminary amendment.
14. ___ A substitute specification.
15. ___ A change of power of attorney and/or address letter.
16. X Other items or information:
    PCT/ISA/210 - Int'l. Search Report (English)
    1 Sheet of Formal Drawings

Applicant Claims Priority under 35 U.S.C. §119 of German Application Nos. 199 25 798.1 and 199 43 072.1 filed June 3, 1999 and September 6, 1999, respectively
Applicant Claims Priority under 35 U.S.C. §120 of: PCT/DE00/01808 filed May 31, 2000

APPLICATION NO. (if known, see 37 CFR 1.5) 09/980343	INTERNATIONAL APPLICATION NO. PCT/DE00/01808	ATTORNEY'S DOCKET NO. MARTIN, G. (PCT)
	CALCULATIONS	PTO USE ONLY

X The following fees are submitted:

Basic National Fee (37 CFR 1.492(a)(1)-(5)):

Search Report has been prepared by the EPO or JPO.....**$890.00**

International preliminary examination fee paid to USPTO (37 CFR 1.482) **$690.00**

Neither international preliminary examination fee paid (37 CFR 1.82) nor international search fee (37 CFR 1.445(a)(2)) paid to USPTO.....**$1,040.00**

International preliminary examination fee paid to USPTO (37 CFR 1.482) and all claims satisfied provisions of PCT Article 33(2)-(4).....**$100.00**

ENTER APPROPRIATE BASIC FEE AMOUNT = $ 890.00

Surcharge of **$130.00** for furnishing the oath or declaration later than ___ 20 ___ 30 months from the earliest claimed priority date (37 CFR 1.492(e)).

Claims	Number Filed	Number Extra	Rate		
Total Claims	23 - 20 =	- 3 -	X **$18.00**	$ 54.00	
Independent Claims	1 - 3 =	- 0 -	X **$84.00**	$	
Multiple dependent claim(s) (if applicable)			+ **$280.00**	$	
TOTAL OF ABOVE CALCULATIONS =				$ 944.00	
Reduction by 1/2 for Small Entity status.				$	
SUBTOTAL =				$ 944.00	
Processing fee of **$130.00** for furnishing the English translation later than ___ 20 ___ 30 months from the earliest claimed priority date (37 CFR 1.492(f)). +				$	
TOTAL NATIONAL FEE =				$ 944.00	
Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31). **$40.00** per property +				$ 40.00	
TOTAL FEES ENCLOSED =				$ 984.00	
				Amount to be: refunded	$
				charged	$

___ Applicant claims Small Entity status.

a. X A check in the amount of $ 984.00 to cover the above fees is enclosed.

b. ___ Please charge my Deposit Account No. 03-2468 in the amount of $_____ to cover the above fees. A duplicate copy of this sheet is enclosed.

c. X The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any overpayment, to Deposit Account No. 03-2468. A duplicate copy of this sheet is enclosed.

NOTE: Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR 1.137(a) or (b)) must be filed and granted to restore the application to pending status.

SEND ALL CORRESPONDENCE TO:
COLLARD & ROE, P.C.
1077 Northern Boulevard
Roslyn, New York 11576-1696
(516) 365-9802

Signature

Edward R. Freedman
Reg. No. 26,048

EXPRESS MAIL NO. **EL 871 449 942 US**
Date of Deposit **November 30, 2001**

I hereby certify that this paper or fee is being deposited with the United States Postal Service "Express Mail Post Office to Addressee" service under 37 C.F.R. § 1.10, on the date indicated above, and is addressed to the Box PCT, U.S. Patent and Trademark Office, P.O. Box 2327, Arlington, VA 22202

Lisa L. Vulpis

PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

APPLICANTS: GÜNTER MARTIN (PCT)

PCT NO.: PCT/DE00/01808

FILED: MAY 31, 2000

TITLE: SURFACE ACOUSTIC WAVE FILTER

PRELIMINARY AMENDMENT

BOX PCT
Ass't. Commissioner for Patents
Washington, D.C. 20231

Dear Sir:

Preliminary to the initial Office Action, please amend the above-identified application as follows:

IN THE ABSTRACT:

Please add the attached Abstract of the Disclosure on a separate page.

IN THE SPECIFICATION:

On Page 1, above line 1, please insert the following paragraphs:

--CROSS REFERENCE TO RELATED APPLICATIONS

Applicant claims priority under 35 U.S.C. §119 of German Application Nos. 199 25 798.1 and 199 43 072.1 filed June 3, 1999 and September 6, 1999, respectively. Applicant also claims priority under 35 U.S.C. §120 of PCT/DE00/01808 filed May 31, 2000. The international application under PCT article 21(2) was not published in English.--

IN THE CLAIMS:

Please amend claim 18 as follows:

18. (Amended) The surface acoustic wave filter according to claim 15, characterized in that the source intensity function and the reflection function are determined by means of an optimization method.

A marked-up version of prior pending claim 18 showing the changes made is attached as Exhibit A.

REMARKS

By this Preliminary Amendment, the application has been amended to conform with U.S. practice, the cross-reference to related applications has been inserted on page 1, claim 18 has

been amended to delete a multiple dependency and an Abstract has been provided. No new matter has been introduced. Entry of this amendment is respectfully requested.

Respectfully submitted,
GÜNTER MARTIN (PCT)

COLLARD & ROE, P.C.
1077 Northern Boulevard
Roslyn, New York 11576
(516) 365-9802

Allison C. Collard, Reg.No. 22,532
Edward R. Freedman, Reg.No. 26,048
Attorneys for Applicants

erf:jc
Enclosure: Abstract
Exhibit A

EXPRESS MAIL NO. **EL 871 449 942 US**
Date of Deposit **November 30, 2001**

I hereby certify that this paper or fee is being deposited with the United States Postal Service "Express Mail Post Office to Addressee" service under 37 C.F.R. § 1.10, on the date indicated above, and is addressed to the Box PCT, U.S. Patent and Trademark Office, P.O. Box 2327, Arlington, VA 22202

Lisa L. Vulpis

ABSTRACT OF THE DISCLOSURE

The invention aims at modifying SPUDT-type surface acoustic wave filters in such a way that the wideband filter can be produced with lower insertion loss and a small form factor without substantially enlarging layout. According to the invention, this is achieved by combining the following characteristics: a) the totality of fingers (231-233; 331-333) of each transducer (2; 3) forms a tapering structure and b) the widths and the positions of the fingers are chosen in such a way that the waves reflected on the fingers (231-233; 331-333) together with the waves regenerated by the corresponding source and load resistance (8; 9) result in an lengthening of the impulse response of the filter, which reduces form factor and/or bandwidth. The invention can be used in surface acoustic wave-based components such as wideband bandpass filters and delay lines.

EXHIBIT A

Marked-up Version of Prior Pending
Claim 18 Showing the Changes Made

18. (Amended) The surface acoustic wave filter according to claim 15 [or 16], characterized in that the source intensity function and the reflection function are determined by means of an optimization method.

1/prts

SURFACE ACOUSTIC WAVE FILTER

Technical Field

The invention relates to objects that can be used and employed in a useful manner in the field of electric engineering and electronics, where structural components based on acoustic surface waves such as wideband bandpass filters and delay lines can be used and employed in a useful manner.

State of the Art

Transducers are known for acoustic surface waves in connection with which two interdigital transducers with divided acoustic reflection are arranged on a piezoelectric substrate. The two transducers are made up of groups of fingers.

In a special embodiment (WO 97/10646) [1], interdigital transducers having a tapering structure are composed of groups of fingers each comprising two or three fingers. In cases where three fingers are provided per group of fingers, two of said fingers form a pair of fingers having no reflection, whereas the third finger in a group is a reflector finger. The spacing between the center lines of the reflector finger and the finger of the pair of fingers located adjacent to said reflector finger typically amounts

to $3\lambda/8$. (λ is the wavelength along a straight line that is associated with the mean frequency, such straight line extending parallel with the collecting electrodes with a preset spacing from one of said collecting electrodes). Each group of fingers consequently has a preferred direction with respect to the generated wave amplitude. A transducer of said type is for that reason a single-phase unidirectional transducer, or abbreviated a SPUDT type transducer. If the width of the reflector finger amounts to $\lambda/4$ or $3\lambda/8$, the groups of fingers are referred to as EWC- or DART-cells. According to the solution [1], the widths of the fingers as a function of the source and/or load impedance are selected in such a manner that the waves reflected on the fingers and regenerated on the source/load impedance compensate each other, so that such a transducer is overall free of reflection. Consequently no interfering echoes occur in spite of adaptation.

In a special embodiment (P. Ventura, M. Solal, P. Dufilié, J.M. Hodé and F. Roux; 1994 IEEE Ultrasonics Symposium Proceedings, pages 1 to 6 [2], the echoes caused as a result of the reflections on the transducers are not only not suppressed, but used for lengthening the pulse response, which results in a lower form factor (corresponding with a greater steepness of the flank) and/or a greater bandwidth. The layouts of surface acoustic wave

filters with the same parameters without said properties have to be substantially longer. An optimization method is commonly employed for the determination as to how the acoustic reflections have to be distributed over the transducers in order to obtain the required filter parameters. As the solution according to [2] actually represents a resonator comprising excitation and reflection centers inserted one into another because the echo is usefully included in conceiving the design of the filter, a structural component of said type is referred to as a resonant SPUDT filter (RSPUDT).

The embodiment according to [2] is afflicted with the drawback that the bandwidth of such type of filters is usefully near 1% at the most. It is consequently not possible to realize wideband filters with low insertion damping.

Representation of the Invention

The invention is based on the problem of changing surface acoustic wave filters of the SPUDT-type in such a manner that wideband filters with low insertion damping and a low form factor can be produced without substantially enlarging their layout.

Said problem is solved according to the invention with the surface acoustic wave filter specified in the patent claims.

For solving the problem, provision is made according to the invention for a combination of the following features:

(a) The fingers of each transducer form in their totality a structure that is tapering in the direction of the fingers; and

(b) The widths and positions of the fingers are selected in such a manner that the waves reflected on the fingers, together with the waves regenerated by the respective source and load resistance result in a lengthening of the pulse response of the filter
that reduces its form factor and/or bandwidth.

The tapering structure can be viewed as a parallel connection of a very high number of narrow filter channels whose transducers differ from each other only by their period length and thus by their mean frequency. Therefore, due to the tapering shape of the structure, a range of mean frequencies is fixed that determines at the same time the bandwidth. The higher the degree of such tapering the greater is the bandwidth. The flank steepness, which determines the form factor, however, can hardly be influenced by the degree of tapering but is primarily

determined by the construction of the filter channels. The combination of features as defined by the invention offers the advantage that even with filters having a tapering structure, the echoes can be employed for lengthening the pulse response as if every filter channel and consequently also the entire filter had a substantially greater number of wave sources, or, in other words, as if every filter were substantially longer than the present layout. This advantage is not offered by the solution according to [1] because the echoes are suppressed in each filter channel due to the fact that each transducer channel per se is without reflection, and consequently each transducer, as a whole, is without reflection due to mutual compensation of the reflection and regeneration.

The invention can be realized in a useful manner as described in the following.

Since it is possible that only one single filter channel has to be included that is representative for all filter channels for the determination of the excitation intensities and reflection factors per group of fingers, it is extraordinarily useful due to considerable time savings obtained in the planing stage to design the tapering form in such a manner that not only equivalent finger widths and gap widths are different from one another along two parallel straight lines, but that also the intermediate spaces

between two transducers differ from each other by one and the same factor, whereby said lines of all fingers intersect each other in such a manner that in each transducer along said lines, the spacings between the center lines of equivalent fingers are the same in all groups of fingers.

The tapering may be realized in such a way that the width of the fingers and of the gaps between such fingers is reduced in steps. It is useful in this connection if all equivalent corner points of one and the same finger edge are disposed on a curve, whereby the straight-lined extensions of all of said curves of the two transducers each intersect one another beyond the respective finger area in one and the same point.

It is especially useful in this connection if each finger stage contains a rectangular finger section each comprising two vertical or parallel limitations in relation to the spreading direction, whereby the limitations of all finger sections of the same stage extending parallel with the spreading direction each form a straight line of limitation, so that the finger areas located between said two straight lines of limitation in each case represent filter channels that are separated from each other by intermediate areas.

Additional collector electrodes may be arranged in this connection in the intermediate areas in such a manner that

if such intermediate areas belong to different transducers, no electrical connection exists in each case between two of said transducers, whereby each additional collector electrode is electrically connected to a collector electrode and the fingers are connected to the additional collector electrodes in such a manner that they have the same electrical potential as if the additional collector electrodes were not present. In the intermediate areas, however, the electrical connection may exist between equivalent finger sections of neighboring filter channels.

All curves on which all equivalent corner points of one and the same finger edge are disposed, may be straight lines, and their extensions beyond the respective finger area of both transducers may be the apparent continuation of said straight lines. The straight-line extensions of the curves beyond the respective finger area may have the direction of the tangent of the respective curve on the borderline of the respective finger area.

A group of fingers may contain two or three fingers. In the latter case, two fingers of each group of fingers may form a pair of fingers, whereby the fingers of a pair of fingers have the same width and are connected to different collector electrodes, and are arranged in relation to one another in such a manner that the pair of fingers is overall without reflection, and that the third finger is in each

case a reflector finger. The embodiments are particularly useful if each group of fingers is a DART- or EWC-cell.

The source intensity of the amplitude excitation and a reflection factor may be associated with each group of fingers in the form of a source intensity function and a reflection function, respectively, whereby the source intensity function and the reflection function can be determined with the help of an optimization method.

The reflection function may be designed in such a manner that the reflection factor in at least one group of fingers has the opposite sign vis-à-vis the other groups of fingers. It is useful if said change in the sign is realized in that the spacing of the reflector finger of said one group of fingers from the other reflector fingers amounts to $n\lambda/2 + \lambda/4$, whereby λ is the wavelength along a straight line associated with the mean frequency, such line intersecting all fingers in such a manner that all groups of fingers along said line in each transducer are equally wide, and ``n'' is an integer.

For the purpose of adjusting a defined source intensity function it is useful if at least a few groups of fingers, which are designated as structured finger groups, are subdivided in at least one transducer parallel with the

collector electrodes in a number of sub-transducers that are electrically connected in series. It is particularly useful in this connection if all sub-transducers of one and the same structured group of fingers have the same aperture.

The number of sub-transducers in at least one structured group of fingers may be different from the number in the other structured groups of fingers.

For the purpose of adjusting a defined source intensity or a defined reflection factor in defined groups of fingers it is useful if the widths of the fingers belonging the respective pair of fingers, or the width of the reflector zinc in at least one group of fingers in at least one transducer are or is different from the widths or width in the other groups of fingers.

The invention is explained in the following in greater detail with the help of an exemplified embodiment and a drawing associated with said embodiment.

Short Description of the Drawing

The drawing shows a surface acoustic wave filter comprised of two interdigital transducers, which are arranged on a piezoelectric substrate.

Best Approach for Realizing the Invention

In connection with the acoustic surface wave filter shown in the drawing, the two interdigital transducers 2 and 3 are arranged on a piezoelectric substrate 1. An intermediate space 4 is present between the transducers 2 and 3. The transducer 2 is composed of the collector electrodes 21 and 22 as well as of the finger groups 23, 24 and 25. Said groups of fingers are shown as representative of a substantially greater amount of finger groups actually composing the transducers. In the direction of the collector electrode 22, the fingers of the transducer 2 are forming a tapering structure in the sense of that the width of the fingers and of the gaps between said fingers are reduced in a step-like manner. The finger groups 23, 24 and 25 are EWC-cells. All of the finger groups 23, 24 and 25 structured identically disregarding the varying average inclination of their fingers. For this reason, only the finger group 23 is described in greater detail. Said group of fingers is composed by the reflector finger 231 and the fingers 232 and 233, the latter two fingers jointly forming a pair of fingers.

The transducer 3 is composed of the collector electrodes 31 and 32 as well as of the finger groups 33, 34 and 35. Said groups of fingers are representative of the substantially greater number of finger groups that the

transducer 3 actually comprises. The fingers of the transducer 3 are forming a tapering structure in the direction of the collector electrode 32 in the sense that the width of the fingers and of the gaps between said fingers is reduced in a step-like manner. The finger groups 33, 34 and 35 are EWC-cells. All finger groups 33, 34 and 35 have an identical structure disregarding the varying average inclination of their fingers. For this reason, only the finger group 33 is described in greater detail. Said group of fingers is composed of the reflector finger 331 and the fingers 332 and 333, the latter jointly forming a pair of fingers.

The filter is composed of the filter channels 201, 203, 205 and 207. The intermediate areas 202, 204 and 206 are located between the neighboring filter channels 201 and 203; 203 and 205; as well as 205 and 206. The finger sections of neighboring filter channels belonging to one and the same finger are connected with each other in said intermediate areas. The intermediate space 4 located between the transducers 2 and 3 is represented in said filter channels by the intermediate spaces 41, 42, as well as 43 and 44. All finger edges extend parallel with one another. However, equivalent finger edges in different filter channels are displaced against each other in such a manner that the intersection points 208 of the left edges of the equivalent sections of one and the same finger are disposed with the

lower line of limitation of the respective filter channel in one and the same straight line. This applies in an analogous manner to the right finger edges as well, where the points 209 have the same meaning as the points 208. Examples of such straight lines are denoted by the reference numerals 210 and 310 in the zone of the transducers 2 and 3, respectively. The average inclination of the edge of a finger is understood to be the inclination of the respective straight line.

The straight lines 20 and 310 are slanted in a manner such that their straight-lined extensions 26 and 36, respectively, intersect one another in one and the same point 5 beyond the respective finger zone. Along the two parallel straight lines 6 and 7, which intersect all fingers of the transducers 2 and 3 in a such a manner that all groups of fingers in each transducer have the same width along said lines, not only the equivalent widths of the fingers and gaps, but also the intermediate spaces 46 and 47 between the two transducers differ by only one and the same factor. In randomly selected filter channels, not only the equivalent widths of the fingers and gaps consequently differ by one and the same factor, but the intermediate spaces 41, 42, 43 and 44 between the two transducers belonging to the selected filter channels vary only by one and the same factor. This property assures that the transmission properties (e.g. the admittance matrix) of all

filter channels can be attributed to transmission properties of one single filter channel. This highly reduces the calculation time required for the analysis of a filter according to the exemplified embodiment. Owing to the fact that an optimization process of a filter analysis has to be carried out many times, the determination of the coefficients of the source intensity and the reflection requires not substantially more time with such a method than the comparable procedure carried out in connection with RSPUDT-filters.

All of the fingers 232 and 233; 332 and 333 forming the pairs of fingers, as well as the fingers not shown, which are equivalent to the former, have the same width within one filter channel. All fingers forming a pair of fingers have a spacing of $\lambda/4$ and are therefore without reflection, whereby λ is the width of a group of fingers in the respective filter channel. However, the reflector fingers 231 and 331, and the fingers that are equivalent to said reflector fingers, but which are not shown, have a varying width in order to realize a defined reflection function. Such reflection function is selected in such a manner that the waves reflected on the reflector fingers, together with the waves regenerated by the corresponding source resistance 8 and the load resistance 9, effect a lengthening of the pulse response of the filter that reduces its form factor and/or

bandwidth. The reflection factor of some of the groups of fingers not shown has an opposite sign as compared to the other groups of fingers. This is realized in that the spacing of the reflector fingers in the affected finger groups of the other reflector fingers amounts to $n\lambda/2 \pm \lambda/4$, whereby ``n'' is an integer. The reflector fingers of the shown finger groups 23, 24, and 25, as well as 33, 34 and 35 have a spacing from each other equal to $n\lambda$. However, if the reflection factor of one of said groups of fingers were negative, the reflector finger of such a group of fingers would have to be shifted by $3/4\lambda$, $5/4\lambda$ or $7/4\lambda$ versus its position in the drawing.

Claims

1. A surface acoustic wave filter on the basis of interdigital single-phase unidirectional transducers (SPUDT-type), in connection with which two of such transducers (2; 3) are arranged on a piezoelectrical substrate with distributed acoustic reflection, such transducers being composed of groups of fingers (23 to 25; 33 to 35) and collector electrodes, characterized by the combination of the following features:

(a) The totality of the fingers (231 to 233; 331 to 333) of each transducer (2; 3) forms a structure tapering in the direction of the fingers; and

(b) The widths and the positions of the fingers are selected in such a manner that the waves reflected on the fingers (231 to 233; 331 to 333) together with the waves regenerated by the corresponding source and load resistance (8; 9) result in a lengthening of the pulse response of the filter that reduces its form factor and/or bandwidth.

2. The surface acoustic wave filter according to claim 1, characterized in that the structure is tapering in the direction of the fingers in such a manner that not only the width of equivalent fingers (231

to 233; 331 to 333) and gaps but also the intermediate space (46; 47) between the two transducers (2; 3) only vary by one and the same factor along two parallel straight lines (6; 7), whereby said lines of all fingers of both transducers intersect one another in such a manner that in each transducer, the spacings of the center lines of equivalent fingers are the same in all groups of fingers.

3. The surface acoustic wave filter according to claim 2, characterized in that in the structure tapering in the direction of the fingers, the width of the fingers (231 to 233; 331 to 333) and of the gaps located between said fingers is reduced in a step-like manner.

4. The surface acoustic wave filter according to claim 3, characterized in that all equivalent corner points (208; 209) of one and the same finger edge are disposed on a curve, whereby the straight-lined extensions (26; 36) intersect of all of said curves of the two transformers (2; 3) intersect each other beyond the corresponding finger area in one and the point.

5. The surface acoustic wave filter according to claim 4, characterized in that each finger stage contains a rectangular finger section with vertical or parallel limitations in relation to the direction of spreading in each case, whereby the two limitations extending parallel with the direction of spreading of all finger sections of the same stage in each case form a straight line of limitation, so that the finger areas disposed in each case between said two straight lines of limitation represent filter channels (201; 203; 205, 207) separated from each other by intermediate areas (202; 204; 206).

6. The surface acoustic wave filter according to claim 5, characterize in that additional collector electrodes are arranged in the intermediate areas (202; 204; 206) in such a manner that in case such additional collector electrodes belong to different transducers (2;3), no electrical connection exists between each two of said additional collector electrodes, whereby each additional collector electrode is electrically connected to a collector electrode (21; 22; 31; 32) and the fingers are connected to the additional collector electrodes in such a manner that they have the same electrical potential as if the additional collector electrodes did not exist.

7. The surface acoustic wave filter according to claim 5, characterized in that in the intermediate areas (202; 204; 206), the electrical connection is made between equivalent finger sections of neighboring filter channels (201; 203; 205; 207).

8. The surface acoustic wave filter according to claim 4, characterized in that all curves are straight lines (210; 310) and their extensions (26; 36) beyond the corresponding finger area of both transducers are the apparent continuation of said straight lines.

9. The surface acoustic wave filter according to claim 4, characterized in that the straight-lined extensions (26; 36) of the curves beyond the corresponding finger area have the direction of the tangent of the corresponding curve at the borderline of the corresponding finger area.

10. The surface acoustic wave filter according to claim 1, characterized in that each finger group (23 to 25; 33 to 35) of both transducers (2; 3) contains two fingers.

11. The surface acoustic wave filter according to claim 1, characterized in that each finger group (23 to 25; 33 to 35) of both transducers (2; 3) contains three fingers.

12. The surface acoustic wave filter according to claim 11, characterized in that three fingers (232; 233; and 332; 333, respectively) of each one finger group (23 to 25; 33 to 35, respectively) form a pair of fingers, whereby the fingers of a pair of fingers are equally wide and are connected to different collector electrodes (21; 22, and 31; 32, respectively), and are arranged in relation to one another in such a manner that the pair of fingers is without reflection overall and the third finger (231 and 331, respectively) is in each case a reflector finger.

13. The surface acoustic wave filter according to claim 12, characterized in that each finger group (23 to 25; 33 to 35) is a DART-cell.

14. The surface acoustic wave filter according to claim 12, characterized in that each finger group (23 to 25; 33 to 35) is an EWC-cell.

15. The surface acoustic wave filter according to claim 12, characterize in that the source intensity of the amplitude excitation is associated with each finger group (23 to 25; 33 to 35) by means of a source intensity function.

16. The surface acoustic wave filter according to claim 12, characterized in that a reflection factor is associated with each finger group (23 to 25; 33 to 35) by means of a reflection function.

17. The surface acoustic wave filter according to claim 16, characterized in that the reflection factor in at least one finger group (23 to 25; 33 to 35) has the opposite sign versus the other groups of fingers, such opposite sign being realized in that the spacing of the reflector finger (231; 331) of said finger group from the other groups of fingers amounts to $n\lambda/2 + \lambda/4$, whereby λ is the wavelength associated with the mean frequency along a straight line intersecting all fingers in such a manner that in each transducer (2; 3), all finger groups (23 to 25; 33 to 35) along said line are equally wide, and that ``n'' is an integer.

18. The surface acoustic wave filter according to claim 15 or 16, characterized in that the source intensity function and the reflection function are determined by means of an optimization method.

19. The surface acoustic wave filter according to claim 15, characterized in that at least some of the finger groups (23 to 25; 33 to 35), the latter being designated as structured finger groups, are subdivided in at least one transducer parallel with the collector electrodes in a number of sub-transducers which are electrically connected in series.

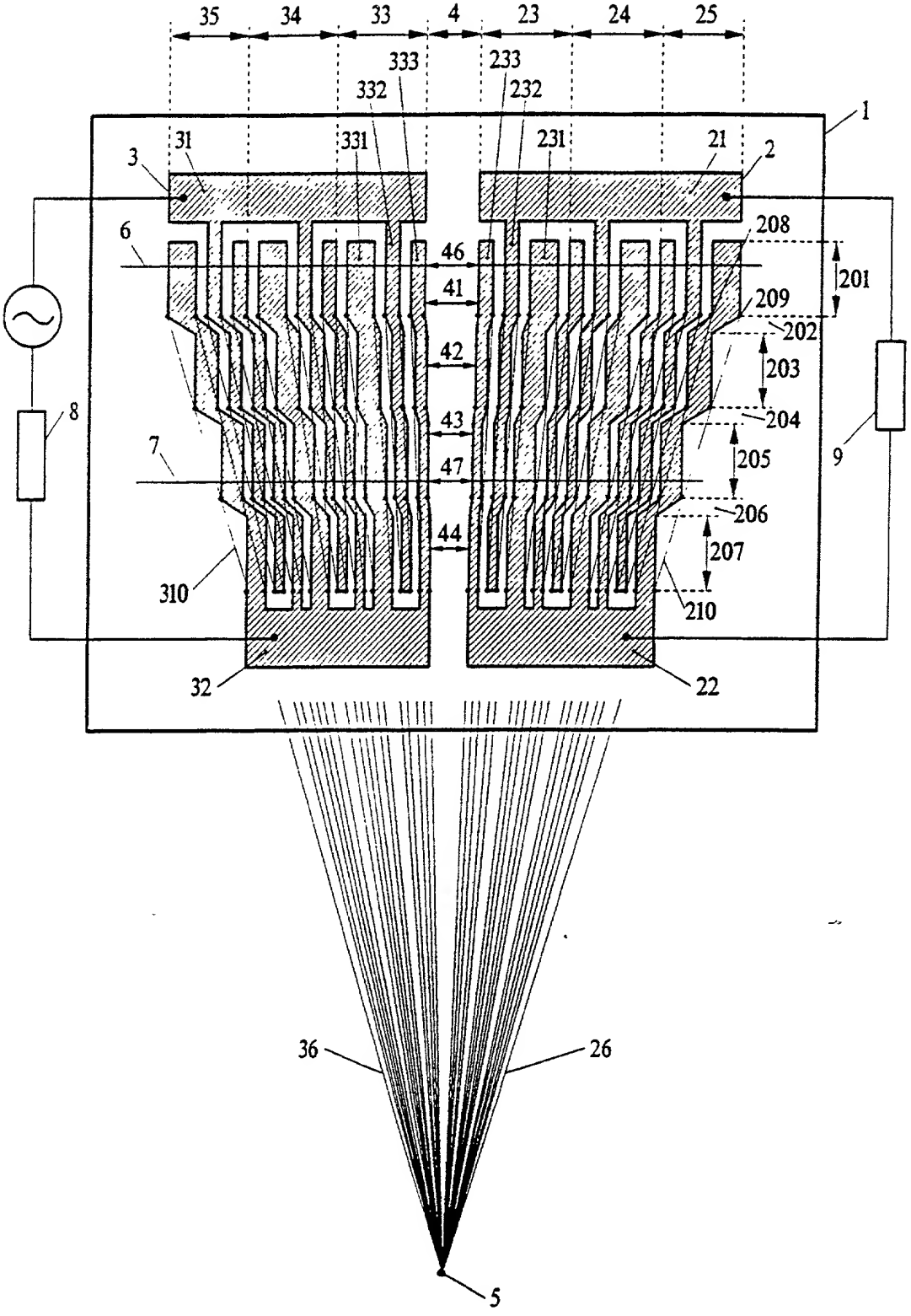
20. The surface acoustic wave filter according to claim 19, characterized in that all sub-transducers of one and the same structured finger group have the same aperture.

21. The acoustic wave filter according to claim 19, characterized in that the number of sub-transducers in at least one structured finger group is different from the number of sub-transducers in the other structured finger groups.

22. The surface acoustic weave filter according to claim 12, characterized in that the widths of the fingers

(232; 233) belonging to a pair of fingers in at least one finger group (23 to 25; 33 to 35) are different from the widths in the other groups of fingers in at least one transducer (2; 3).

23. The surface acoustic wave filter according to claim 12, characterized in that the width of the reflector finger (231; 331) in at least one finger group (23 to 25; 33 to 35) in at least one transducer (2; 3) is different from the one in the other finger groups.


35
34
33
4
23
24
25
333
233
332
232
1
31
331
231
21
2
3
6
208
46
201
41
209
202
42
203
8
204
43
7
205
47
9
206
44
207
310
210
32
22
36
26
5

COMBINED DECLARATION FOR PATENT APPLICATION AND POWER OF ATTORNEY (Includes Reference to PCT International Applications)	ATTORNEY'S DOCKET NUMBER MARTIN, G PCT

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below next to my name,

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled:

SURFACE ACOUSTIC WAVE FILTER

the specification of which (check only one item below):

[ ] is attached hereto.

[ ] was filed as United States application

Serial No. _____

on _____,

and was amended

on _____ (if applicable).

[X] was filed as PCT international application

Number PCT/DE00/01808

on 31 MAY 2000,

and was amended under PCT Article 19

on _____ (if applicable).

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information which is material to the examination of this application in accordance with Title 37, Code of Federal Regulations, §1.56(a).

I hereby claim foreign priority benefits under Title 35, United States Code, §119 of any foreign application(s) for patent or inventor's certificate or of any PCT international application(s) designating at least one country other than the United States of America listed below and have also identified below any foreign application(s) for patent or inventor's certificate or any PCT international application(s) designating at least one country other than the United States of America filed by me on the same subject matter having a filing date before that of the application(s) of which priority is claimed:

PRIOR FOREIGN/PCT APPLICATION(S) AND ANY PRIORITY CLAIMS UNDER 35 U.S.C. 119:

COUNTRY (if PCT, indicate "PCT")	APPLICATION NUMBER	DATE OF FILING (day, month, year)	PRIORITY CLAIMED UNDER 35 U.S.C. 119
GERMANY	199 25 798.1	3 JUNE 1999	[X] YES [ ] NO
GERMANY	199 43 072.1	6 SEPTEMBER 1999	[X] YES [ ] NO
			[ ] YES [ ] NO
			[ ] YES [ ] NO
			[ ] YES [ ] NO

COMBINED DECLARATION FOR PATENT APPLICATION AND POWER OF ATTORNEY (Includes Reference to PCT International Applications)	ATTORNEY'S DOCKET NUMBER MARTIN, G PCT

I hereby claim the benefit under Title 35, United States Code, Section 119(e) of any United States provisional application(s) listed below.

(Application Number) (Filing Date)

I hereby claim the benefit under Title 35, United States Code, §120 of any United States application(s) or PCT international application(s) designating the United States of America that is/are listed below and, insofar as the subject matter of each of the claims of this application is not disclose in that/those prior application(s) in the manner provided by the first paragraph of Title 35, United States Code, §112, I acknowledge the duty to disclose material information as defined in Title 37, Code of Federal Regulations, §1.56(a) which occurred between the filing date of the prior application(s) and the national or PCT international filing date of this application:

PRIOR U.S. APPLICATIONS OR PCT INTERNATIONAL APPLICATIONS DESIGNATING THE U.S. FOR BENEFIT UNDER 35 U.S.C. 120:

U.S. APPLICATIONS		STATUS (Check One)		
U.S. APPLICATION NUMBER	U S. FILING DATE	PATENTED	PENDING	ABANDONED

PCT APPLICATIONS DESIGNATING THE U.S.

PCT APPLICATION NO.	PCT FILING DATE	U.S. SERIAL NUMBERS ASSIGNED (if any)			

POWER OF ATTORNEY: As a named inventor, I hereby appoint the following attorney(s) and/or agent(s) to prosecute this application and transact all business in the Patent and Trademark Office connected therewith (List name and registration numbers): KURT KELMAN, Registration No. 18,628

ALLISON C. COLLARD, Registration No. 22,532; WILLIAM C. COLLARD, Registration No. 38,411
EDWARD R. FREEDMAN, Registration No. 26,048; FREDERICK J. DORCHAK, Registration No. 29,298
ELIZABETH COLLARD RICHTER, Registration No. 35,103 ROBERT W. GRIFFITH, Registration No. 48,956

Send Correspondence to: COLLARD & ROE, P.C. 1077 Northern Boulevard Roslyn, New York 11576 Customer No. **25889**

Direct Telephone Calls to *(name and telephone number)* (516) 365-9802

2	FULL NAME OF INVENTOR 1-00	FAMILY NAME MARTIN	FIRST GIVEN NAME GÜNTER	SECOND GIVEN NAME
0	RESIDENCE & CITIZENSHIP	CITY DRESDEN	STATE OR FOREIGN COUNTRY GERMANY	COUNTRY OF CITIZENSHIP GERMANY DEX
1	POST OFFICE ADDRESS	POST OFFICE ADDRESS COMENIUSSTRASSE 24	CITY D-07307 DRESDEN	STATE & ZIP CODE/COUNTRY GERMANY

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.

SIGNATURE OF INVENTOR 201

Günter Martin

DATE Oct 24, 2001